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COMMERCIUM INTERRUPTUS:
SUPPLY CHAIN RESPONSES TO DISASTER

ACQUISITION POLICY

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INTRODUCTION

The industrial base that the Department of Defense (DoD) depends on for weapon systems and other materials has participated in the transition to supply chain management along with the rest of industry. The pressures that led industry to just in time delivery systems, total quality manufacturing and lean manufacturing coupled with the improvements in information management eventually resulted in the processes of supply chain management. With regard to supplies, once a company knew where their, inbound materials were because of the linkages of computer systems, had a guaranteed date of delivery from an information-enabled distribution system, and had the assurance of a consistent level of quality from their supplier, there was no longer any need to maintain large stocks of inventory. This created enormous savings for companies because they kept much less inventory on hand.

Supply chain management (SCM) is defined many ways in the literature of the field. For this paper the operative definition is "the process of managing relationships, information and materials flow across enterprise borders to deliver enhanced customer service and economic value through synchronized management of the flow of physical goods and associated information from sourcing to consumption.'" The specific area of interest in this case is the dependent relationship between a manufacturer or integrator and his or her suppliers. Experience has shown that under ideal conditions the use of SCM contributes to effective, efficient processes that yield increased profits for a producer and better support for customers. However, there have been at least two recent events that constituted far from ideal conditions; namely, the terrorist attacks on

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[1] LaLonde, Bernard quoted in Mentzer, John T., et. al., "Defining Supply Chain Management," *Journal of Business Logistics, 22, Issue 2, 2001, p.8.*

September 11, 2001 and the dockworkers strike in California during the fall of 2002. What happens to the supply chain when conditions are not ideal, and how have contractors chosen to protect themselves and their customers, including DoD, from the negative effects of such disruption?

SUPPLY CHAINS TODAY

Since the beginning of the era of mechanized mass production of goods, manufacturers typically insured timely access to the raw materials needed to produce products by having stockpiles of those materials on hand. They had in-plant supply rooms and nearby warehouses containing everything needed to keep production lines running for some period of time. The purchasing department was held responsible for making contracts with various suppliers to provide deliveries of all these items before stocks were depleted, so production could continue uninterrupted. Inevitably, problems would arise that would cause shortages or surpluses of material from time to time. Shortages would be noticed immediately because of the impact to the production line. The effect of periodic surpluses was more subtle and didn't become evident until businesses began using information technology and integrated systems, and until they faced significant competition within their industry sectors.

Material on hand for production represents a cost for the company that owns it. They may have thousands or even millions of dollars tied up in inventory that will not contribute to profit until it is converted into an end product and sold. If a company found a way to maintain production and sales at the same rate, but have less money tied up in inventory, they could immediately increase profitability because their costs are lower. As

businesses began to use information technology to plan production (e.g., material resource planning), they could pinpoint specifically when supplies would be needed. As the distribution industry (trucking, rail, and shipping) began using information technology to track their moving assets, they' could provide precise time of delivery information to customers. Manufacturers began to take advantage of guaranteed delivery times and made arrangements with raw material suppliers to meet those terms. Manufacturers, in turn, gave guaranteed delivery dates, to their customers. Over time, various computer systems were integrated within a company. When they began linking electronically with supplier and distributor systems, the supply chain was created. Now a manufacturer (or DOD component) no longer has to have physical possession of material. They just need to know where it is and when it will arrive at its destination. This is the basis for characterizations of the supply chain as "inventory at 600 miles per hour," referring to airborne freight, or "managingg information, not inventory." [2]

This highly interdependent web of suppliers, distributors, and producers is based on real-time information and accuracy. Lead times for deliveries have been cut to hours in some cases, because the technology supports it and because ownership of inventory costs money. Manufacturers want to get it into production and sell a finished product as quickly as possible. A disruption to any of these processes can be catastrophic for a company. Various companies have suffered production line shutdowns in the past for many reasons - inclement weather delaying shipments, contaminated or poor quality raw materials that cannot be used, train derailments, labor disputes with workers, and the like.

[2] This may be a short version of the statement "In modem supply chains, information replaces inventory," cited by Simchi-Levi, David, et. al., in *Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies.* Boston: Irwin McGraw Hill, 2000.

Solutions were worked out on an individual basis. The terrorist attacks and the dockworkers' strike caused disruption in the supply chains of almost the entire country.

The September 11 attacks brought distribution to' a halt nationwide for several industries. Air freight was halted because all planes were grounded for several days. Border crossings with Canada and Mexico were closed, stopping truck deliveries of a plethora of materials we import from those countries, and offloading of ships at ports was stopped, so material from overseas sources was not being delivered either. Ford Motor, Company actually experienced a five plant production shutdown due to parts shortages caused by these delays. At the time, no one was sure if there would be more attacks or' what type of threat we might face, so a draconian approach was taken to provide a level of security against that.

In the case of the dockworker strike, the problem was the inability to get cargo off ships and onto trucks and trains for delivery to the customers in the United States. This was an issue of capacity, rather than security. Both are instances of major disasters that had widespread negative impacts on supply chain processes.

Supply Chain Disaster Responses

Logistics experts, scholars, and others have proposed ways for businesses to prevent the serious disruptions to production that may occur due to crises of the magnitude being discussed here. The solutions fall into one of the following categories: insurance, hedging, substitution, or burden shifting. Each category embodies a different level of cost to the manufacturer and provides a different level of assurance that supplies

will be available when needed. Each firm must decide how critical an assured source of supply is for their business and how much they are willing to pay for it.

SUPPLY CHAIN DISASTER RESPONSES		
COST	**RESPONSE**	**ASSURANCE**
$$$	**INSURANCE** Stock on hand C-TPAT certification	+++
$$	**HEDGING** Alternate suppliers Alternate distribution	++
$$	**SUBSTITUTION** Alternate parts Alter customer choice	++
	BURDEN SHIFTING Vendors carry stock Vendors stock nearby	

Insurance Solutions. The alternatives in this category are the most expensive to implement, but they also provide the maximum level of assurance that supplies will be available when needed. Using these alternatives, manufacturers may choose to stock inventory again, incurring the cost of the material itself, and the warehouse management costs that come with it. Manufacturers also may require their non-domestic suppliers and associated distributors to become certified through the Customs Trade Partnership Against Terrorism (C-TPAT) systems with the U.S. Customs Service. This program will allow certified shippers to avoid waiting in line for inspections at ports and border crossings. As part of Customs' efforts to "push the border outward,"[3] it expands security

[3] Aichlmayr, Mary. "Mission Critical: Closing Security Gaps." *Transportation & Distribution,* 43: May 2002, p. 28.

surveillance procedures to personnel and storage arrangements. C-TPAT provides recommendations for employee screening and for physical security and detection systems for places where goods are stored. The intent is to prevent placement of a terrorist weapbn of some sort in a shipping containers bound for the United States. This additional effort will probably result in higher prices for the manufacturers, and ultimately for consumers.

Hedging Solutions. The solutions in this category are less expensive and they provide less certainty that supplies will be available. Each manufacturer should perform a risk analysis for his product line It may turn outthat there are a few critical supplies it is necessary to guarantee a source for. Using hedging solutions, a manufacturer would make advance arrangements with alternate suppliers to get the critical items he needs, or alternate arrangements with other distributors that can deliver products if the primary distributor cannot. The alternate suppliers may be domestic rather than overseas. The manufacturer may calculate that the certainty of losing 100 percent of a sale because he cannot deliver an item is worth the additional cost to use a domestic source and pay more for a component, thereby accepting a lower profit but retaining a customer. The alternate sources may require a deposit or other fee for assuring access to their source of inventory or capacity, or they may charge higher prices for faster than normal delivery.

Substitution Solutions. These solutions require manufacturers to determine alternates for the components used to create their final products. They may make arrangements in advance to shift to these alternate items and suppliers, should access to their primary sources be blocked.

If the range of products provided by a particular manufacturer will support it, they may solve a problem of disruption of the supply chain by convincing their customers to accept substitute products. This will require some additional effort to identify the near-equivalent parts, and to persuade customers to try them. The items also may have to be sold at a discount to help gain customer acceptance. The manufacturer may judge this a small price to pay to avoid losing a sale or a customer.

Burden Shifting Solutions. The solutions require other business entities, to bear the cost of assured supplies. Major manufacturers may require their vendors to hold stock for them, or they may require them to make arrangements to store supplies close to the manufacturer. For an overseas supplier, this may mean finding warehouse space someplace inside the continental United States.

Other Solutions. Some SCM software providers have recommended that manufacturers purchase enhanced supply chain software This software should provide greater inventory visibility, have the ability to model "what if' scenarios, have enhanced warehouse management capabilities, and provide closer links to suppliers. This "event management" software would be programmed to raise an alert if there were indications from the supply chain that a potential disruption was about to occur. While this may prove useful for ordinary disruptions of the supply chain, it certainly would not be able to predict another terrorist attack. Its value would be the advance planning and preparation by company management to prepare contingency plans in case of such an occurrence.

Some authors have pointed out the nearly universal existence of disaster recovery plans for firms' information technology assets, but the similarly universal lack of disaster plans for the supply chain. Omar Keith Helferich and Robert Cook, authors of a paper

entitled "Securing the Supply Chain" attribute the low level of preparedness to "a low priority because of competing business issues, the lack of recognition of the true level of disaster vulnerability, and an assumption that the service and government sectors are responsible for disaster response."[4]

Industry Reaction

At a recent conference entitled "Securing the Supply Chain: A Workshop to Maximize Supply Chain Preparedness" sponsored by the Council of Logistics Management (CLM), the majority'of concerns expressed by the company representatives attending centered on the distribution system and how it could be strengthened. Many attendees were convinced that the "voluntary" C-TPAT' certification would be effectively mandatory for efficient functioning, and they wanted information on how to get themselves and their distribution partners certified. In response to ad hoc inquiries about company responses to major disruptions of their supply chains, some indicated they had established better communication processes that would help secure alternate sources if a similar situation developed in the future, but they did not increase inventory. A representative from a telecommunications company stated that they established a catalog of equipment needed to respond to emergencies, and had stored some emergency supplies. Because of the critical nature of their services, no quantitative analysis was performed. Maintaining service was the clear priority, not the cost of maintaining inventory.

[4] Dupin, Chris. " What If? Many Shippers are Neglecting Disaster Planning." *Journal of Commerce.* November 11, 2002, p. 22.

Several companies that are part of the Strategic Materials Industry Study were sent a survey (copy provided as attachment 1)to get information about their actions in response to supply chain disruptions. None of the respondents increased inventory on hand. They indicated little to no disruption in their businesses because of the two disasters, nor have they changed their inventory or distribution posture in anticipation of another major disruption. One company pointed out that the threat of terrorist attacks was the negative effect on the economy which led, to a decline in orders from their customers.

CONCLUSION

The survey of current literature shows there are many alternatives firms may pursue to prevent or ameliorate major supply chain disruptions. There is little evidence that any solutions have been implemented. It would be improper to generalize the impact of supply chain disruption for DoD based on the small sample size reached by the survey or at the CLM conference, so further research with a greater number of suppliers is needed. It is possible that some defense suppliers may ask DoD to bear the cost of increased insurance for supplies or distribution, or they may request authorization to ship finished products using government transportation systems. That is the polar opposite of several years of policy direction to use commercial systems wherever possible, but the need for security may override the mandate to decrease the size of government and lower costs.

Compliance with C-TPAT may evolve to be a positive factor in government contract evaluation. Alternatively, suppliers may be asked to map their supply chains to

provide assurance that they know where all their materials come from and have an idea how secure' those routes are. Instead of asking whether a contractor can surge production in case of rapidly increased customer demand, they may be asked if they have established, relationships for alternate sources of supply in case of disaster. With the near-term hostilities in Iraq, and the open ended Global War on Terrorism, the threat of disaster due to terrorist acts will remain high for the United States. It would be prudent for DoD contractors and all businesses to develop supply chain disaster response and recovery plans.

SURVEY QUESTIONS

Did your company experience a negative impact to production or delivery schedules because of the events of September 11, 2001 or the west coast dockworkers strike? If so, please describe briefly what the impact was.

How has the company responded?

Have you increased inventory on hand, or required your suppliers to increase inventory carried for you? If you increased inventory, how was the additional cost justified?

Have you developed alternate sources of supply?

Have you developed alternate delivery methods for your supplies?

Is your company C-TPAT certified? Do you require your supply chain partners to be C-TPAT certified?*

Please describe any other changes you have made to your supply chain in response to September 11, the west coast dockworkers strike, or any other disaster or major disruption.

Did the disruptions caused by the September, l 1 terrorist attack or the dockworkers strike have special impact on your company because of the products you produce (e.g., strategic materials)?

*C-TPAT is the Customs-Trade Partnership Against Terrorism. Shippers that are certified get preferential treatment at ports and border crossings so they don't have to wait as long.

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